Deep Learning Management in Education: A Meta-Analysis of Empirical and Theoretical Studies

Bambang Wahrudin[1*], Sugeng Riadi[2], Nurul Abidin[3]
[1]*Universitas Muhammadiyah Ponorogo, Jawa Tmur Indonesia*
[2]*Universitas Ahmad Dahlan, Yogyakarta, Indonesia*
[3]*Universitas Muhammadiyah Ponorogo, Jawa Tmur Indonesia*

Corresponding Author.
**arqomedu1@umpo.ac.id*

Abstract: *This article discusses deep learning management in education through meta-analysis of empirical and theoretical studies with a qualitative approach based on literature studies. The urgency of this research arises from the need to improve the quality of the learning process that is able to develop students' critical understanding, creativity, and high-level thinking skills. The methods used include the collection and selection of relevant literature from various international databases, thematic analysis, and qualitative synthesis of the results of previous research that discuss the concepts, strategies, and implementation of deep learning management. The findings show that deep learning management is effective when it integrates a holistic, collaborative, and reflective approach, as well as makes adaptive use of technology. In addition, educational leadership and teacher training are key factors in optimizing the implementation of deep learning. The study also identified challenges such as resistance to change and resource constraints that need to be addressed to ensure the sustainability of these practices. In conclusion, deep learning management is an important pillar in educational transformation centered on developing learners' cognitive and affective capacities, and requires a clear framework and systemic support from all stakeholders.*
Keywords: *Learning, Management, Deep-Learning, Meta-Analysis.*

1. INTRODUCTION

The quality of education today faces a major challenge in the form of the low ability of students to master High Order Thinking Skills (HOTs), literacy, and numeracy which are crucial requirements in facing the dynamics of increasingly complex science and technology development. This condition is exacerbated by inequality in the quality of education and changes in the times that are difficult to predict, such as the phenomenon of demographic bonuses and the demands of the industrial revolution 4.0, which demand a more in-depth and effective learning model (Michael Fullan Maria Langworthy, 2014) (Abdul Mu'ti, 2025). This is where the importance of deep learning management as an educational strategy to develop conceptual understanding, reflective skills, and the application of knowledge in a real-world context.

In today's digital era, the learning process at various levels of education faces increasingly complex challenges, especially in accommodating the characteristics of students who are increasingly accustomed to fast access to information and intensive use of technology. The phenomenon of easy access to information through digital devices has changed the way students learn, which tends to lead to *surface learning* and the tendency to think instantly without deep understanding (Abdul Mu'ti, 2025). This condition is inversely proportional to the demands of 21st century competencies that require learners not only to memorize facts, but to be able to perform critical analysis, synthesis, and complex applications of knowledge in real-life contexts.(Hattie & Donoghue, 2016).

Data from the 2023 National Assessment shows that only around 34% of junior high school students in Indonesia have reached the minimum level of reading literacy competence, while adequate numeracy skills are

only around 40% (Assessment and Learning Center of the Ministry of Education and Culture, 2023). This gap is exacerbated by unequal access to technology and digital infrastructure in various regions, especially in remote and remote areas, which risks widening the gap in education quality (Anton & Behne, 2020). Therefore, it is necessary to implement deep learning management that is able to integrate student-centered learning strategies, optimal use of information technology, and sustainable development of character and higher-level thinking skills (Fischer-Tenhagen et al., 2016) (Michael Fullan Maria Langworthy, 2014). This approach is a strategic solution to overcome the weaknesses of conventional learning and facilitate an educational process that is adaptive, inclusive, and responsive to technological developments and the needs of today's students.

Deep learning theory underlies this concept, with Biggs and Moore (1993) emphasizing the importance of the interaction between presage, process, and product factors in meaningful, conscious, and joyful learning (Anton & Behne, 2020). Deep learning emphasizes intrinsic motivation, collaboration, and reflective experiences to deliver applicative and sustainable learning (McLeod, 2017).

Deep learning management includes planning, organizing, implementing, and evaluating that combines pedagogical principles and digital technology collaboratively (Riyadi, 2015; BBPMP Central Java, 2025). Effective implementation requires educational leadership that acts as a catalyst for quality learning culture change and systemic support for teachers and stakeholders (Michael Fullan Maria Langworthy, 2014).

This article presents a qualitative meta-analysis of empirical and theoretical studies to summarize the latest findings, as well as identify challenges and strategic solutions in deep learning management to strengthen theoretical frameworks and implementation practices at various levels of education.

2. METHOD

This study uses a qualitative method with a literature study approach (literature review) which focuses on meta-analysis of empirical and theoretical studies of deep learning management in educational contexts. This approach was chosen to summarize, synthesize, and interpret the findings of various relevant studies that have been published in national and international journals. The data collection process is carried out systematically through searching literature in reliable databases such as Google Scholar, SINTA, ERIC, and international journal portals using strict inclusion criteria so that only relevant and valid studies are analyzed (Yin, 1981).

In data analysis, source triangulation, data triangulation, and theory triangulation techniques are used to increase the validity and reliability of findings. Source triangulation refers to the integration of information from a variety of different articles and reports, while data triangulation involves using a number of different research data. Theoretical triangulation is carried out by comparing the results of empirical research with existing theoretical frameworks to enrich the understanding and interpretation of the results (Watajdid et al., 2021). The analysis was carried out by organizing the data thematically and identifying patterns, similarities, and contradictions between studies, then a narrative synthesis was carried out to draw comprehensive conclusions (Siswanto, 2010).

With this method, the research seeks to provide a comprehensive overview of effective deep learning management practices, challenges, and strategies, as well as become a theoretical and empirical basis for the development of educational policies and practices in the future. This qualitative approach to literature review is expected to bridge the gap between theory and practice and provide evidence-based recommendations that are applicable in the context of deep learning.

3. RESULTS AND DISCUSSION

Deep learning management is a concept that integrates pedagogical and managerial principles in an effort to create a learning process that is aware, meaningful, and joyful for students. Deep learning itself emphasizes comprehensive understanding and in-depth mastery of competencies within the scope of the material studied, so that students not only memorize, but are able to apply, analyze, and construct knowledge in diverse contexts (Biggs & Moore, 1993; Hattie & Donoghue, 2016; Ministry of Education and Culture Curriculum Team, 2017). In this case, learning management is closely related to systematic planning, organizing, implementing, and evaluating in order to achieve optimal learning goals (Riyadi, 2015; Adi & Santoso, 2024).

1. Basic Concepts of Deep Learning

Deep learning is a learning approach that emphasizes deep understanding of concepts, meaningful knowledge construction, and active involvement of students in a reflective and critical learning process (Ministry of Education and Culture, 2017; Fullan & Langworthy, 2014). This approach is not just memorizing or repeating information, but involves a process of awareness in which students become active

and independent learners, able to understand the meaning of the subject matter and apply it in a broad real context (Ministry of Education and Culture, 2017). The main characteristics of deep learning include three principles: mindful learning, meaningful learning, and joyful learning, both of which are integrated to build a holistic and sustainable learning experience (Ministry of Education and Culture, 2017; AnsarLangnge, 2025).

The fundamental difference between deep learning and surface learning lies in the goals and cognitive processes that students undergo. Surface learning tends to focus on superficial memorization and mastery of the material without understanding the relationships between concepts, which often happens due to exam demands or academic pressure alone (Marton & Säljö, 1976; Smith & Colby, 2007). On the contrary, deep learning encourages students to comprehensively explore the meaning of concepts, connect new ideas with old knowledge, and conduct critical reflection on the content of the material so as to be able to produce creative solutions and real applications (Fullan et al., 2018; Kuanta.id, 2025). Through deep learning, learners not only remember information, but are able to transfer and adapt knowledge to a variety of complex and dynamic situations.

The importance of critical and reflective understanding in deep learning cannot be separated from efforts to develop high-level thinking skills that are urgently needed in this digital and information age (Hattie, 2009; Pellegrino & Hilton, 2012). These skills include analysis, evaluation, and synthesis skills that allow learners to become individuals who not only passively receive knowledge, but actively evaluate and create new knowledge. Reflection as an integral part of deep learning allows students to assess their own learning process, including obstacles and successful strategies, so that learning becomes more personalized and meaningful (Kolb, 1984; Fullan & Langworthy, 2014). Thus, deep learning is not only a pedagogical approach, but also an educational philosophy that prepares learners to face complex challenges in the future.

1. Learning Theories That Support Deep Learning Management

1. 3P (Presage, Process, Product) Theory by Biggs and Moore

The 3P theory developed by Biggs and Moore (1993) in their book "The Process of Learning" is an important conceptual framework in understanding the factors that influence the learning process, especially in the context of the application of deep learning. The 3P model consists of three main components: Presage (initial factor), Process (process factor), and Product (result factor), which are dynamically and sequentially interrelated in the learning cycle (Biggs & Moore, 1993; Ministry of Education and Culture, 2025).

Presage is the factors that exist before the learning process begins, including the characteristics of students such as ability, background, previous experience, attitude, and motivation, as well as the conditions of the learning environment and the teaching context. This factor determines how students will respond to the learning process and greatly influences the learning approach they choose, whether deep learning or surface learning (Biggs & Moore, 1993; Fullan et al., 2018). Learners with high intrinsic motivation tend to use a deep learning approach, which involves critical conceptual understanding, analysis, and reflection, while extrinsically motivated learners are more susceptible to using a surface approach that focuses solely on memorization and completion of tasks (Marton & Säljö, 1976; Lewin, 2008).

Process reflects the learning activities and approaches that occur during the learning process, including how learners manage learning strategies, interactions in learning, and cognitive and affective engagement. At this stage, deep learning is characterized by the active involvement of students in exploring meaning, reflecting on the content of learning, and connecting new knowledge with existing knowledge (Biggs & Moore, 1993; Smith & Colby, 2007). Learning methods that support deep learning are usually collaborative, contextual, and provide space for creative exploration and problem-solving (Fullan & Langworthy, 2014).

Products are the result of the learning process that can be seen at the level of concept mastery, critical thinking skills, creativity, and the ability to apply knowledge in a real context by students. Learning outcomes within the framework of 3P are not just test scores or scores, but reflect the quality of continuous understanding and competence (Biggs & Moore, 1993; Pellegrino & Hilton, 2012). Thus, deep learning produces meaningful learning products, in contrast to surface learning products that are usually temporary and superficial.

This 3P model provides a strong theoretical foundation for designing and managing learning to take place effectively and meaningfully. By understanding the relationship between presage, process, and product factors, teachers and education stakeholders can design learning management strategies that are able to intrinsically motivate students, optimize the learning process, and produce quality learning outcomes that are relevant to the needs of the 21st century (Ministry of Education and Culture, 2025; Fullan et al., 2018).

a. Teori Experiential Learning oleh Kolb

Teori Experiential Learning yang dikembangkan oleh David A. Kolb pada tahun 1984 is one of the main foundations in the development of experiential learning models. According to Kolb, learning is a process of change that occurs through direct experience that is then reflected, conceptualized, and re-tested in a continuous cycle (Kolb, 1984; Fathurrohman, 2024). Experience is not only a source of learning, but it is the process of understanding and transforming experience that fosters new knowledge and more meaningful skills for learners (Amin & Sumendap, 2022). Therefore, experiential learning is seen as a holistic learning approach that integrates cognitive, affective, and psychomotor aspects simultaneously.

The Experiential Learning cycle model consists of four main stages that are interrelated and form the wheel of learning: Concrete Experience (concrete experience), Reflective Observation (reflective observation), Abstract Conceptualization, and Active Experimentation (Kolb, 1984; Kuanta.id, 2025). The first stage is a real-life experience that encourages learners to interact with the learning environment directly. Furthermore, students reflect on the experience by critically observing various aspects and consequences that arise. The third stage involves the formulation of a concept or theory that explains the experience. The final stage is the application of the concept through experimental actions in the actual learning environment, which will generate new experiences and move the learning cycle back to the original stage repeatedly.

Kolb also puts forward six main propositions underlying experiential learning, including that learning is a continuous and holistic process that involves the active adaptation of learners to the world around them, and that learning occurs through the resolution of conflicts between different learning styles and modes (Kolb & Kolb, 2005; Fathurrohman, 2024). This approach makes experiential learning very relevant in contemporary education which requires students to not only receive passive information, but actively learn from experience, develop critical thinking, creativity, and applicative problem-solving skills.

In the context of deep learning management, Kolb's experiential learning theory provides a solid foundation for designing learning processes that prioritize learners' active engagement, meaningful reflection, and continuous adjustment to the learning environment. The implementation of this theory is able to bridge differences in learning styles, increase intrinsic motivation, and foster an essential lifelong learning attitude in facing the era of globalization and digital technology (Muhammad Fathurrohman, 2024; Abdul Majid & Rochman, 2023).

1. Intrinsic Motivation Theory in Deep Learning

Intrinsic motivation is the motivation to learn that comes from within the learner, such as curiosity, interest, and personal satisfaction while learning, without dependence on rewards or pressure from outside parties (Sardiman, 1996; Nurmala, 2014). In the context of deep learning, intrinsic motivation is a key element that moves students to actively build a comprehensive and sustainable understanding of concepts (Ministry of Education and Culture, 2025). Intrinsically motivated learners not only learn to achieve grades or meet external demands, but because they have a deep interest in and satisfaction with the material being studied that encourages active engagement, reflection, and the development of independent learning strategies (Emda, 2017; Abdul Mu'ti, 2025).

Some of the factors that affect intrinsic motivation include satisfaction in learning, interest in certain topics, and the achievement of learning outcomes that provide personal pride (Saksono, 2023; Siti Masitoh, 2022). When learners experience this intrinsic motivation, the learning process tends to take place with high quality because they are encouraged to explore the material critically and creatively (Fullan et al., 2018; Pellegrino & Hilton, 2012). In contrast to extrinsic motivation that relies on external incentives such as grades or punishments, intrinsic motivation results in more long-lasting learning commitments and enhances the high-level thinking skills that are essential for deep learning success (Santrock, 2007; Nurmala, 2014).

In deep learning practice, teachers play a role in facilitating and nurturing students' intrinsic motivation through challenging learning design while providing space for exploration, positive feedback, and a learning environment that supports curiosity and creativity (Ministry of Education and Culture, 2025; Fathurrohman, 2024). This is in line with the findings of various studies that confirm that learning that targets students' psychological needs such as a sense of competence, autonomy, and social connectedness will significantly increase intrinsic motivation and learning outcomes (Deci & Ryan, 2000; Emda, 2017; Abdul Mu'ti, 2025).

Overall, intrinsic motivation theory provides a strong framework for the development of deep learning management strategies with a focus on empowering learners as active agents of sustainable and meaningful learning.

In the context of learning management, the role of teachers as facilitators, drivers, and coaches of learning culture is crucial to create a conducive and collaborative learning environment (BBPMP Central Java, 2025). Deep learning management also demands optimal use of digital technology to enrich the learning experience and support personalization of learning (Marblestone et al., 2016; Adi & Santoso, 2024). The deep learning framework includes four main elements: pedagogical practices, learning partnerships, learning environments, and harmonious and synergistic use of digital technology (Education in Motion, 2018).

Empirical research conducted by various studies shows that deep learning management contributes significantly to improving students' critical thinking skills, creativity, and problem-solving abilities (Smith & Colby, 2007; Fullan & Langworthy, 2014). However, challenges in its implementation such as resistance to change, limited resources, and unequal access to technology are obstacles that must be overcome through visionary and collaborative educational leadership (Yin, 2018; Anton et al., 2025).

Thus, deep learning management is not only an ideal vision in the context of modern learning, but also an urgent need to prepare learners for a future full of uncertainty and complexity. This approach emphasizes the importance of synergy between learning theory, management practice, and educational technology in creating a sustainable and adaptive educational ecosystem.

The results of a qualitative meta-analysis with a literature study approach on deep learning management in education show that the implementation of effective management strategies greatly contributes to the optimization of deep learning that prioritizes active student involvement, the development of critical thinking skills, and deep reflection on learning materials (Moradimokhles, 2024; Fullan et al., 2018). Research reveals that learning management that successfully integrates careful planning, the use of adaptive digital technology, and collaborative educational leadership support can drive the transformation of the learning process towards meaningful deep learning (Moradimokhles, 2024; BBPMP Central Java, 2025).

1. Deep Learning Planning

A qualitative meta-analysis based on literature studies conducted on various empirical and theoretical studies shows that deep learning management plays an important role in improving the quality of students' learning processes and outcomes. The implementation of good management including comprehensive planning, the implementation of student-centered learning, accompanied by continuous reflective evaluation, has been proven to encourage active engagement, the development of critical thinking skills, and a deep understanding of the material (Fullan et al., 2018; Ministry of Education and Culture, 2025). Schools and educational institutions that adopt deep learning management consistently report increased intrinsic learning motivation and more significant outcomes in a wide range of learners' cognitive and affective competencies (Moradimokhles, 2024; BBPMP Central Java, 2025).

In the operational realm, deep learning management not only includes the management of content and learning methods, but also the arrangement of a conducive learning environment and the use of innovative and interactive digital technology. Studies have found that the use of educational technology, such as online learning platforms, interactive applications, and artificial intelligence-based learning management systems, can personalize the learning experience to meet individual needs and learning styles and encourage deeper reflection (Lan, 2025; Light-IC, 2025). However, the main challenge lies in the readiness of human resources, especially teachers, as well as uneven technological infrastructure, so it is necessary to strengthen teacher capacity and invest in targeted technology (Moradimokhles, 2024; BBPMP Central Java, 2025).

The analysis also underscores the importance of school leadership and culture in supporting deep learning management. Collaborative and visionary leadership is able to create an inclusive and innovative learning climate, as well as facilitate the professional development of teachers to be able to adapt deep learning practices in a sustainable manner (Fullan et al., 2018). The research studied indicates that the

synergy between education policy, learning management, and digital technology is the main foundation for realizing education that is responsive and adaptive to the needs of the 21st century (Pellegrino & Hilton, 2012; Lan, 2025).

2. Implementation of Deep Learning

The findings also highlight the important role of teacher readiness as agents of change, which requires ongoing training and institutional support to be able to design and implement deep learning innovatively, especially in environments with limited technological infrastructure (Cahaya-IC, 2025). Obstacles such as limited access to technology, lack of teacher training, and institutional cultural resistance are the main obstacles that must be overcome through sustainable professional development policies and strategies (Cahaya-IC, 2025; Moradimokhles, 2024).

In addition, meta-analysis shows that the digitization of learning with the integration of artificial intelligence elements has a significant positive impact on the organization of independent learning and monitoring of students' learning progress, although some challenges related to the accuracy of AI systems and the availability of quality data still need to be improved (Lan, 2025). This indicates that the management of deep learning in the future must combine advanced technological resources with an inclusive and humanistic pedagogical approach to maximize learning outcomes.

Further discussion highlights that deep learning management is not only limited to technical aspects, but also to the development of a culture of collaborative learning, contextual learning, and the provision of constructive feedback to strengthen learners' intrinsic motivation (Fullan et al., 2018; Pellegrino & Hilton, 2012). Therefore, this study recommends the expansion of teacher training programs with a focus on technology competencies and deep learning pedagogy as well as increased investment in educational infrastructure in various regions.

3. Evaluation and Development

The results of this qualitative meta-analysis through this literature study confirm that the evaluation and development of deep learning management is a crucial aspect that must continue to be strengthened to ensure the sustainability and effectiveness of learning at various levels of education. Deep learning management evaluation focuses not only on the final learning outcomes, but also on the planning, implementation, and monitoring processes that are carried out systematically to identify strengths and weaknesses in learning practices (Fullan et al., 2018; Ministry of Education and Culture, 2025). This study reveals that the use of evaluation indicators in the form of active student involvement, depth of understanding, critical thinking skills, and quality of interaction in the classroom is an effective way to measure the impact of deep learning management (Moradimokhles, 2024; BBPMP Central Java, 2025).

In the development of deep learning management, research shows the importance of integrating digital technology as a tool to improve the efficiency of evaluation and sustainability of learning (Lan, 2025). Artificial intelligence-based learning systems, for example, are able to provide real-time feedback that supports students' self-regulated learning, as well as assist teachers in analyzing learning data more accurately and personally (Cahaya-IC, 2025). However, challenges such as limited infrastructure and teachers' readiness to utilize technology are still obstacles that need to be overcome through continuous training and comprehensive supporting policies (BBPMP Jateng, 2025).

Furthermore, the development of deep learning management must pay attention to inclusive and collaborative aspects of educational leadership to encourage pedagogical innovation and a positive learning culture (Fullan et al., 2018). Joint evaluation between teachers, students, and policy makers is an important strategy to ensure that learning management remains adaptive to the needs of students and changes in the learning environment. In addition, the use of evidence-based development approaches and reflective practices allows deep learning management to be continuously improved and adapted to local and global contexts (Pellegrino & Hilton, 2012; Moradimokhles, 2024).

Overall, the results of this study emphasize that deep learning management is a key element in improving the quality of education that is adaptive, sustainable, and responsive to the demands of the times, and demands synergy between innovative policies, technologies, and teaching practices.

4. CONCLUSION

Based on the results of qualitative meta-analysis research with a literature study approach, deep learning management in the field of education emphasizes the importance of strategic planning, intensive implementation, and continuous evaluation and development to achieve optimal learning outcomes. Deep learning planning must

pay attention to student characteristics, curriculum needs, and technology integration so that the learning process leads to active engagement and deep conceptual understanding. The implementation of good deep learning management includes the application of learning methods that encourage intrinsic motivation, collaboration, and critical reflection of students so as to create a dynamic and innovative learning environment.

Evaluation of deep learning management functions as a tool to measure the effectiveness of learning processes and outcomes which is also a material for evaluating and developing future learning strategies. Evaluation is carried out holistically by involving stakeholders, including teachers and students, and utilizing digital technology to improve the accuracy and relevance of data. The development of deep learning management needs to be supported by visionary educational leadership and a collaborative school culture so that learning innovations can continue to be improved and adapted to the times.

The researcher concluded that deep learning management is not only a pedagogical practice, but also an integral educational paradigm. This approach is able to answer the challenges of 21st century education by preparing students who have a strong conceptual understanding, critical thinking skills, creativity, and the ability to adapt to global changes. Therefore, it is increasingly important for educational institutions to optimize deep learning management through investment in teacher training, the development of learning technologies, and policies that support the overall transformation of education.

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